WHAT IS CLAIMED:

1. A method for providing spread spectrum communication between first and second apparatus which transmit and receive RF pulse type signals, comprising the steps of:

generating a first message signal by said first apparatus consisting of a sequence of modulated RF pulses;

transmitting the RF pulses of the first message signal to the second apparatus;

receiving the RF pulses of the first message signal transmitted by the first apparatus by the second apparatus;

generating a second message for transmittal to the first apparatus upon receipt of the first message;

encoding in the second apparatus alternate RF pulses in the sequence of the received first message with the second message by applying a pseudo random time delay and a pseudo random phase shift to each of the alternate RF pulses;

transmitting encoded alternate RF pulses containing the second message back to the first apparatus as a relatively low power level spread spectrum transmission during intervening pulses between the alternate pulses of the RF pulses of the first message;

receiving the encoded alternate RF pulses containing the second message by the first apparatus;

decoding the encoded RF pulses containing the second message; and

displaying the second message by the first apparatus.

2. The method of claim 1 wherein the first apparatus comprises a radar system and the second apparatus comprises an RF tag.

3. The method of claim 2 wherein the pseudo random time delay of the RF pulses produces shifts in apparent range, and the pseudo random phase shifts produce discrete incremental changes that prevent the pulses from coherently adding unless the random seed and tag message have been deduced.

4. The method of claim 3 wherein the respective time delays and phase shifts of the RF pulses do not add coherently from pulse to pulse.

5. The method of claim 1 wherein the first apparatus comprises an airborne radar and the second apparatus comprises a digital RF tag.

6. The method of claim 5 wherein the pseudo random time delays of the RF pulses produce range hopping and wherein the pseudo random phase shifts produce shifts in angular direction.

7. The method of claim 6 wherein the RF tag comprises a ground based digital RF tag and wherein the first message signal comprises a downlink signal and the second message comprises an uplink signal.

8. The method of claim 6 wherein the step of encoding includes the step of generating a pseudo random noise code having a seed which is common to both the radar and the tag.

9. The method of claim 8 wherein the step of encoding includes the steps of generating a preamble pulse sequence for making initial detection of a transmission from the tag, generating one or more pulse sequences of message symbols containing the message content desired to be sent back to the radar from the tag, and generating a last symbol pulse sequence for ending the transmission from the RF tag.

10. The method of claim 9 wherein the message symbols comprise soft symbols wherein hard decisions are not required at symbol boundaries.

11. The method of claim 10 wherein each of the soft symbols include a sequence of related message pulses having predetermined message content.

12. The method of claim 11 wherein the message content of the soft symbols depends on the message content of the previous soft symbol and the step of decoding includes sequential depruning of a hypothesis tree of the message content of the soft symbols.

13. The method of claim 9 wherein depruning comprises feeding the sequence of related message pulses of each of the soft symbols through a trellis network that branches out at every one of the related soft symbol message pulses.

14. The method of claim 11 wherein the trellis network is implemented by a set of matched filters each having mutually different filter characteristics whereby unlikely hypotheses are discarded at the soft symbol boundaries.

15. A system for providing spread spectrum communication between radar mounted on a vehicle and at least one RF tag, comprising:

means for generating a downlink signal by the radar consisting of a sequence of modulated RF pulses for use by said at least one RF tag;

means for transmitting the downlink signal to the RF tag and wherein the downlink signal operates to wake up the RF tag, as well as providing identification of the radar transmitting the downlink signal and signal parameters for an uplink signal from the tag;

means for receiving the downlink signal by the RF tag;

means for generating a message signal for transmittal to the radar;

means for encoding the message signal in alternate RF pulses of the received downlink signal by applying a pseudo random time delay for providing range hopping and a pseudo random phase shift to each of the alternate RF pulses for producing random shifts in angular direction;

means for transmitting encoded alternate RF pulses containing the message signal back to the radar as a relatively low power level spread spectrum uplink signal during intervening pulses between the alternate pulses of the RF pulses of the downlink message;

the radar further including:

means for receiving the encoded alternate RF pulses containing the message signal in the uplink signal;

means for decoding the encoded RF pulses containing the message signal; and

means for displaying a decoded message signal.

16. The system of claim 14 wherein the radar comprises an airborne radar mounted on an aircraft and said at least one RF tag comprises a ground based digital RF tag.

17. The system of claim 15 where said at least one RF tag comprises a plurality of RF tags and wherein the RF pulses transmitted from the RF tags are transmitted to the radar in a code division multiple access (CDMA) methodology.

18. The system of claim 17 wherein each of the tags includes a digital RF memory for capturing the alternate RF pulses in the downlink signal.

19. The system of claim 17 wherein each of the RF tags includes means for a pseudo random noise code having a seed for enabling signal correlation which is common to both the radar and the RF tag.

20. The system of claim 19 wherein the seed is a randomly selected seed.

21. The system of claim 19 wherein the message signal includes, a preamble pulse sequence for making initial detection, a plurality of message

symbol pulse sequences of the message content to be sent back to the radar, and a last symbol pulse sequence for ending the message signal.

22. The system of claim 21 wherein the message symbol sequences comprise soft symbols.

23. The system of claim 22 wherein each of the soft symbols includes a sequence of related message pulses having predetermined message content.

24. The system of claim 23 wherein the message content of the soft symbols depend on the message content of the previous soft symbol.

25. The system of claim 24 wherein the means for decoding includes a trellis network implementing a hypothesis tree for depruning the message content of the soft symbols.

26. The system of claim 25 wherein the trellis network that branches out at every pulse of the successive soft symbol message pulses.

27. The system of claim 26 wherein the trellis network comprises a set of matched filters, each having mutually different filter characteristics.